Computational fluid dynamics (CFD) is an engineering tool that uses numerical methods to analyze physical phenomena involving fluid flow. Multiphase flows, in particular, present many challenges due to intricate mixing and interfacial transients that can occur. Southwest Research Institute® (SwRI®) engineers have more than 30 years of experience in using and customizing both commercial and SwRI-developed CFD codes to meet client needs.

SwRI conducts research for a diverse range of clientele problems in the oil and gas industry, space science, medical community, food processing, environmental agencies, and the Nuclear Regulatory Commission. Reasons for employing CFD alone, or in conjunction with experimental testing, may include the need for:

- Rapid analysis with reduced resource requirements
- Fewer prototype iterations
- Corroboration of experimental results
- Investigation of parameters not obtainable via traditional experimental techniques (due to time scales, impracticality of sensor placement, visual obstructions, etc.)

**Applications**

SwRI engineers have applied CFD techniques to model a wide variety of industrial scenarios, including:

- Oil and gas production/transport
- Pipeline accidental spill and leak assessment
- Space vehicle propellant dynamics
- Environmental flows
- Combustion
- Medical device operation
- Food processing
- Fluid-structure interactions

Using state-of-the-art software in combination with parallel processing capabilities, SwRI strives to provide timely solutions for development and operational challenges.

**Simulations**

- **Porous boundary analysis using model developed from experimental data taken as part of the same multiphase SwRI project**
- **Simulation of landslide-generated tsunami event from Lituya Bay in Alaska**
- **Slosh modeling analyses carried out under a 1-g environment (left: nuclear steam suppression tank response to earthquake) and 0-g environment (right: propellant flow dynamics in spinning satellite)**

**Models**

- **SwRI-developed emulsion model used to predict batch separation of oil-water mixtures for separation technology**
Southwest Research Institute is a premier independent, nonprofit research and development organization using multidisciplinary services to provide solutions to some of the world's most challenging scientific and engineering problems. Headquartered in San Antonio, Texas, our client-focused, client-funded organization occupies 1,200 acres, providing more than 2 million square feet of laboratories, test facilities, workshops, and offices for nearly 2,600 employees who perform contract work for government and industry clients.

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